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The topside behavior in the mesospheric sodium layer observed by lidar at Yanqing (40.46°N, 115.98°E) and at Haikou (20.01°N, 110.32°E)

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Due to meteoric ablation, large amounts of metal atoms deposit in the mesopause region, forming the metal layers that can be observed by ground-based lidars. It is widely acknowledged that the meteoric metal layers are normally confined to altitudes of 75-115 km. In fact, the observable upper limit of the topside layer depends largely on the performance of the instruments, the integration time and the observation conditions. With the support of the Chinese Meridional project in the eastern hemisphere, two brand new sodium fluorescence lidars with the same configuration were respectively set up at Yanqing (40.46°N, 115.98°E) and at Haikou (20.01°N, 110.32°E) in April, 2010. They displayed powerful detection capabilities which allow us to study the topside behavior of the mesospheric sodium layer.

Based on the observations made at Yanqing between April 2010 and June 2012 and those at Haikou between April 2010 and December 2012, seasonal variations of sodium densities were studied. Comparison between these two sites (∼2300 km apart) reveals a strong correlation in the topside sodium layer. Independently of their seasonal characteristics at lower altitudes, they both show an extension to 120 km and above, predominantly during summer. 90 nights of simultaneous observations at these two sites shows that the variation trends of sodium densities above 102 km are remarkably similar in contrast to their different seasonal characteristics below 98 km. At 105 km the correlation coefficient reaches up to 0.71, and almost all of the major peaks can be found one by one with their relative strengths reproduced to a large degree. It indicates that the topside extension effect is global in the mesospheric sodium layer, combined with the observations at other latitudes. Comparison with known meteor showers shows that most of these extensions correspond well to one or more meteor showers, although not one by one. Meteor showers with velocities less than 35 km/s appear to have more influence on these extensions.